



## LETTERS TO THE EDITOR

### RE: "CANCER IN KOREAN WAR NAVY TECHNICIANS: MORTALITY SURVEY AFTER 40 YEARS"

In a recently published analysis, Groves et al. (1) extended the original 20-year cohort mortality study of 40,000 US Navy veterans of the Korean War (1950–1954) by Robinette et al. (2) to encompass a 40-year follow-up period. Groves et al. concluded that "radar exposure had little effect on mortality in this cohort" (1, p. 810). For such a conclusion to be sound, the veterans' actual exposure to radar must be clearly defined, but this was not demonstrated in the paper by Groves et al.

The original study (2) was a study of 20,000 men with "maximum opportunity for exposure," such as those working in electronic equipment repair (Groves et al. termed this the "high-exposure" group), and 20,000 men with "minimum potential for exposure," such as those working in electronic equipment operation (Groves et al.'s "low-exposure" group). However, in the original article, Robinette et al. stated that "actual exposure to members of each cohort could not be established" (2, p. 39). Even the high-exposure group was said to have exposures probably below 1 mW/cm<sup>2</sup> during duty hours, although it was also stated that "their exposure pattern... infrequently includes exposures larger than 100 mW/cm<sup>2</sup>" (2, p. 42). However, there was no interpretation of "infrequently," be it daily, weekly, monthly, or annually. This is a crucial weakness, because the distinction between the maximum and minimum exposure-opportunity groups largely rests on the occurrence of these undefined infrequent high exposures. Because of the ill-defined nature of these exposures, misclassification is likely, and therefore comparisons between the maximum/high and minimum/low exposure groups are tenuous at best. Results should be reported tentatively rather than as if they were part of an established gradient of exposure, as Groves et al. implied in their table 4.

Robinette et al. (2) also recognized the need to assess duration of assignment on ships during the 5-year war as an important parameter of exposure. Assignments might range from a few months to a few years. Robinette et al. generated a "Hazard Number" that included assignment durations for the 435 deaths studied, in an attempt to adjust for this (2). However, Groves et al. (1) did not make any adjustment for duration of service on-board ships for the 8,393 deaths they studied, so this important exposure parameter was not taken into account.

Thus, while the exposure to radar of the Navy veterans in terms of intensity and duration was ill-defined in the study by Robinette et al. (2), it was even more poorly defined in the Groves et al. study (1). Extending the follow-up time from 20 years to 40 years does not compensate for this basic deficiency. The main conclusion that can be drawn from the data as presented by Groves et al. is that US Navy veterans of the

Korean War who were exposed to radar at undetermined average exposure levels of less than 1 mW/cm<sup>2</sup> for unspecified durations of less than 5 years do not have increased mortality.

#### REFERENCES

1. Groves FD, Page WF, Gridley G, et al. Cancer in Korean War Navy technicians: mortality survey after 40 years. *Am J Epidemiol* 2002;155:810–18.
2. Robinette CD, Silverman C, Jablon S. Effects upon health of occupational exposure to microwave radiation (radar). *Am J Epidemiol* 1980;112:39–53.

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#### THE AUTHORS REPLY

We thank Dr. Hocking (1) for pointing out the difficulty of quantifying radar exposures in this cohort. As we mentioned in our report, "The weaknesses of the study include the lack of dosimetry for microwave exposures and other occupational and environmental chemical exposures, misclassification of exposures due to the reliance on job titles, [and] the absence of exposure information after naval duty..." (2, p. 817). We did not generalize about the health effects of specific microwave exposures; we only reported on the health effects observed in the Navy Korean War veteran cohorts. We did conclude, however, that "it appears that radar exposure had very little effect on mortality in this cohort of US Navy veterans" (2, p. 818).

#### REFERENCES

1. Hocking B. Re: "Cancer in Korean War Navy technicians: mortality survey after 40 years." (Letter). *Am J Epidemiol* 2003; 157:279.
2. Groves FD, Page WF, Gridley G, et al. Cancer in Korean War Navy technicians: mortality survey after 40 years. *Am J Epidemiol* 2002;155:810–18.

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